Student Number _____   Stu

University of Saskatch

EE 352 Communicatio

Quiz #1 – Mar.14/2

Time: 25 minutes

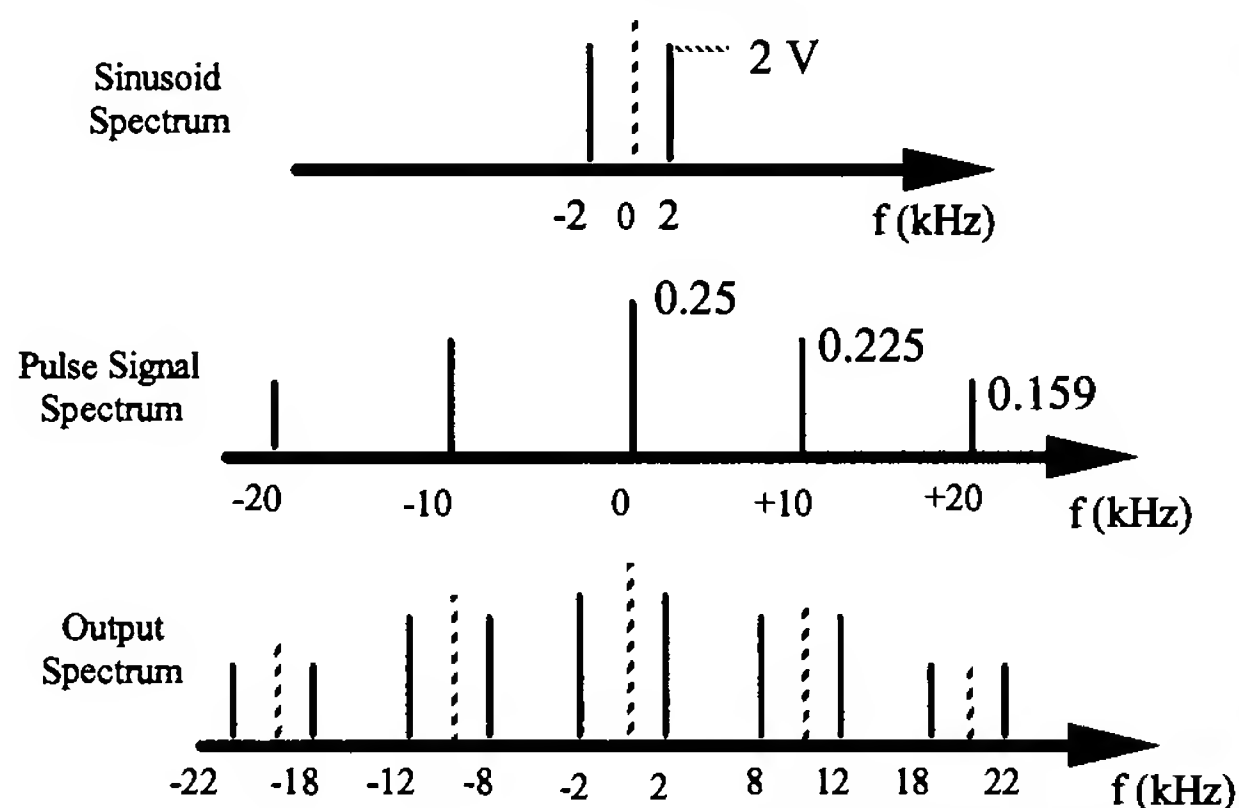Permitted: - text, printed notes, student's own *hand-written* materials

Use the space below each question for your answer.

4 2
5 **2**
6 **½**

7½
──
10

1   Complete the following drill problem (1 point)

Example 4.1 – Natural Sampling A signal containing a 2.82 Vrms tone at 2 kHz is presented to the sampling gate. The sampling pulse sequence has frequency 10 kHz and duty cycle 25%. What frequencies will be present in the output of the sampling gate?

Solution: 2 kHz, 8 kHz, 12 kHz, 18 kHz, 22 kHz, ...

Drill Problem 4.1
Determine the rms voltages of all frequency components up to 25 kHz.

f (kHz)	V rms
2	0.705
8	0.635
12	0.635
18	0.448
22	0.448
Checksum	2.871

*2   A PAM multiplexing system interleaves samples from 24 voice channels. The system bandwidth for the voice channels is 3.4 kHz. (2 pts)

   i)   What is the maximum duty cycle of the sample pulses for one voice channel.

$$\frac{1}{24}$$ ✓

   ii) Considering the sampling theorem and the properties of practical filters, suggest a practical aggregate sample rate on the transmission channel connecting the transmitter and receiver.

   there is the minimum = 6.8 K Hz   ∴ 20 K Hz will work   too large to be practical

*3   A baseband color television signal has frequency components as high as 4.6 MHz. (2 pts)   aggregate rate is 24×

   i)   What is the theoretical minimum sampling rate that can be used to faithfully reproduce this signal?
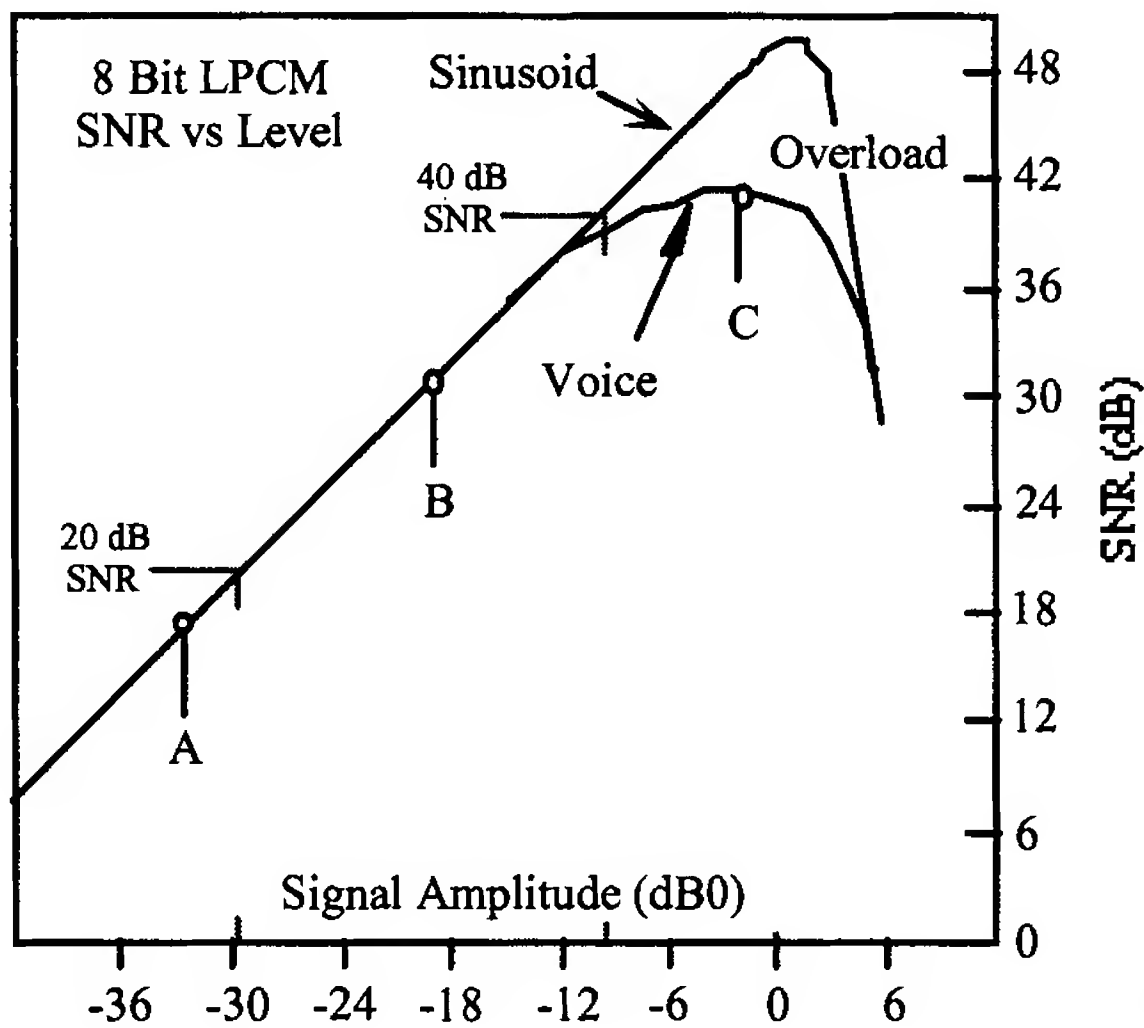
   9.2 MHz   ✓

   ii) Suggest a practical minimum sampling rate.

   4 Times would leave more room for the filter

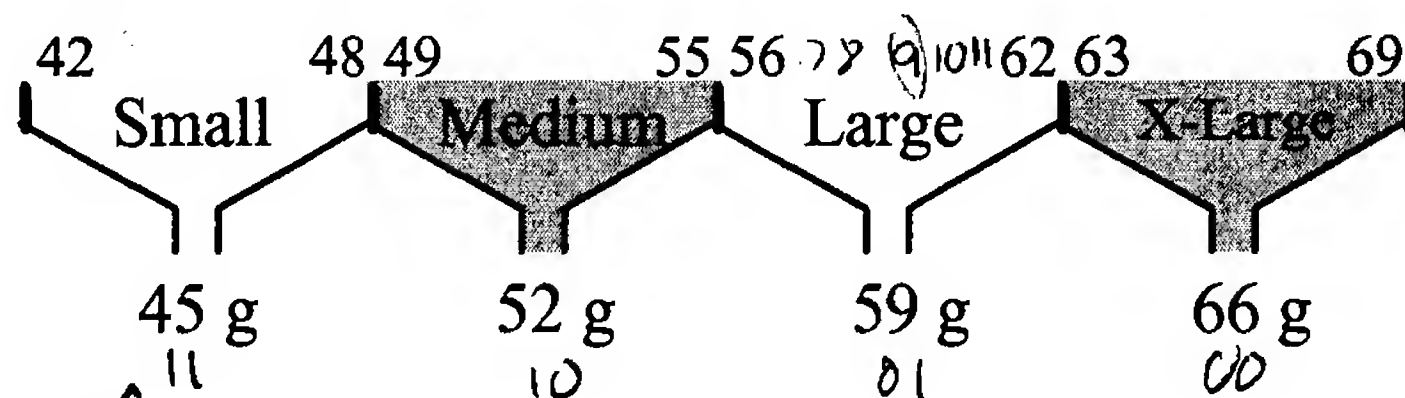   ∴ ≈ 20 MHz   too large for practical minimum.

4. The graph illustrates 8-bit LPCM SNR for sinusoids and for voice. (2 pts)
    * i) Identify the points A, B, and C as talking, whispering and shouting.
    ii) Explain why voice SNR is less than sinewave SNR as the signal level approaches the overload level (0 dB0). *Hint:* voice contains several frequency components.

8 Bit LPCM SNR vs Level — Sinusoid, Overload, Voice, 40 dB SNR, 20 dB SNR, points A, B, C. SNR (dB) axis: 0, 6, 12, 18, 24, 30, 36, 42, 48. Signal Amplitude (dB0) axis: -36, -30, -24, -18, -12, -6, 0, 6.

i) a → whispering ✓
   B → Talking ✓
   C → shouting ✓

ii) ~~It's is because the rate has dynamic range.~~ There will be clipping of some part of the signal as you approach full load. ∴ you must leave room for the peaks. This will reduce the average signal level. ✓

5. The following illustration represents quantizing bins for the grading eggs. What is the range of error (in grams) when the large egg is assumed to be exactly 59 grams? How many binary bits are required to represent the "quantized" egg sizes shown ? (2 pts)

42   48 49   55 56 57 58 59 60 61 62 63   69
  Small   Medium   Large   X-Large

45 g   52 g   59 g   66 g
 11   10   01   00

a) ±3 g ✓

B) 2 bits ✓

6. How many minutes of music can be stored on a 1.5 megabyte floppy disk if 16 bit quantization is used at a sampling rate of 44.1 kHz. Assume monaural recording. (1 pt)

END

1 meg = 1024 bytes

1 byte = 8 bits

$(1.5 \text{ megbytes})(1024 \text{ bytes/megabyte})(8 \text{ bits/byte}) = 12.288 \times 10^3 \text{ bits}$

need 16 bits ∴ $\dfrac{12.288 \times 10^3 \text{ bits}}{16 \text{ bits}} = \dfrac{768}{44.1 \text{ kHz}} = 0.017 \text{ s}$